Blurring the Boundaries of the Mackintosh Room

Matthew Chalmers[1], Barry Brown[1], Steve Benford[4], Ruth Conroy[3], Nick Dalton[3], Areti Galani[1], Chris Greenhalgh[4], Ian MacColl[1], Danius Michaelides[5], Dave Millard[5], Cliff Randell[2], Anthony Steed[3], Tom Rodden[4], Ian Taylor[4], Mark Weal[5]

[1] The University of Glasgow, Glasgow UK, http://www.equator.ac.uk/partners/glasgow.htm
[2] The University of Bristol, Bristol UK, http://www.equator.ac.uk/partners/bristol.htm
[3] University College London, London UK, http://www.equator.ac.uk/partners/ucl.htm
[4] The University of Nottingham, Nottingham UK, http://www.equator.ac.uk/partners/notts.htm
[5] The University of Southampton, Southampton UK, http://www.equator.ac.uk/partners/soton.htm
http://www.equator.ac.uk/projects/city/

ABSTRACT

In this paper we describe a prototype interactive system supporting a shared synchronous experience for physical, World Wide Web and virtual reality visitors to an exhibition devoted to the designer and architect C.R. Mackintosh. The system provides awareness between visitors that spans multiple media while also providing location- and device-sensitive content to each visitor.

Keywords

Ubiquitous computing, shared visiting, multiple media, context-sensitive content.

THE CITY PROJECT

As part of a project called *City*, we are exploring ways to treat the city and information so as to deliberately blur the boundaries between physical and digital media. Extending the way that people increasingly use digital media to prepare for a visit to a city, such as World Wide Web (WWW) pages, and 2- and 3-dimensional presentations such as maps and virtual reality (VR) models, we have combined mobile, WWW and VR interfaces into one larger system. We are exploring ways that people can interact and maintain awareness of each other, and share location– and device–sensitive content, even though they may be spatially or temporally separated, and using a variety of interaction devices and media.

The initial setting of our work is an exhibition in The Lighthouse (www.thelighthouse.co.uk) devoted to the life and work of Charles Rennie Mackintosh (1868–1928), the architect, designer and artist. The visitors and curators of the exhibition are the initial user community for our work. We have carried out observational studies of this community, and background research on the design and use of both the exhibition and The Lighthouse—Mackintosh's first major public building.

At a more general level, we are working to weave digital media into the physical streets, buildings and artefacts that people use, and to do this in meaningful ways, that is, ways that fit, show and support their activity. We tend to focus on obvious differences between physical and digital media and treat each one independently, but in the *City* project we are seeking a broader viewpoint that takes account of the similarities and interdependencies of different media.

The *City* project is set within an Interdisciplinary Research Collaboration called Equator (www.equator.ac.uk) that involves computer scientists, sociologists, psychologists, artists and designers. University College London (UCL) and the universities of Bristol, Glasgow, Nottingham and Southampton are taking part in the *City* project, with Glasgow as lead.

COMPONENTS IN A LARGER SYSTEM

Our prototype system includes components from *City* partners: wearables from Bristol, the *Linky* hypermedia link server from Southampton [3], and the *EQUIP* data sharing platform from Nottingham that includes MASSIVE-3 (www.crg.cs.nott.ac.uk), VRJuggler (www.vrjuggler.org), Bamboo (www.watsen.net) and NSPR (www.mozilla.org).

Design and development has been based on a series of scenarios, defining interaction and technical design issues. The scenarios include a character for each of the interactive media we are using: a physical visitor with a wearable computer (*Vee*), a WWW visitor (*Dub*) and a VR visitor (*Ana*). We retain these names for describing the system in the remainder of this section.

The system infrastructure supports all three visitors in essentially similar ways. Position and orientation data for a visitor is sent to an *EQUIP* data space where it is transformed from Cartesian coordinates to human–meaningful location names. Each visitor's context, in terms of location and device, is used to query *Linky* for content to display. Context–specific content is stored in the data space, and visitor client programs are advised of its availability—and also of the positions of all visitors for awareness presentation. In addition to position awareness, the visitors share an audio circuit.

Vee has a wearable computer, based on an HP Jornada 568, with fine–grained position and orientation sensors [4]. Content is presented as HTML in a browser, and the positions of other visitors are shown on a map or radar display. *Dub* interacts with a map applet in a WWW browser, with position and orientation derived from mouse clicks. Content is presented in a separate frame, and visitor positions are shown on the map. *Ana* interacts with an immersive or non-immersive VR display, with position and orientation derived directly from the VR model. Other visitors are shown as VR avatars, and content is presented in a WWW browser (although we are experimenting with Jornadas for VR manipulation and content display). **Figure 1** shows *Ana's* view with content in the browser on the left, and *Dub* and *Vee* in the VR rendering on the right.

Figure 1 Ana's view showing VR rendering and content

We have conducted limited public demonstrations of the system in the Mackintosh Room, and simulated the room at two other locations in the UK. We observed that visitors in the roles of *Vee* and *Ana*, in particular, carefully managed their bodily positions with respect to each other, as in conventional virtual environments, and showed little problem with mapping between physical objects and those in the VR model. Talking was vital to the support of mutual reference. Our plans for shared audio–based content take account of these observations, as well as recent work on the sharing and overlapping of audio guides [5].

There are several places in the room where one can stand in a position but, depending on the direction one faces, look at different exhibits and zones. Orientation data helps to determine a visitor's focus of attention, but not always. A person may be facing one exhibit while talking about another with his or her companions. We have also observed people continuing to listen to an exhibit's audio description after moving on to look at other exhibits. Location, orientation and devices at hand, as well as who is where, who is reading what and who is talking to whom, are just some of the simpler features we can incorporate into the model of a user's context. One strand of future work in the City project moves towards revealing the patterns of past activity in the various media that change a space into a place [2]. After logging visitor activity, we can show patterns of use graphically in maps and VR, and use those patterns to recommend people, places and artifacts [1].

CONCLUSION

We have designed and built a prototype system for shared physical, WWW and VR visiting experiences. The system provides a technical infrastructure for social awareness across different media with context-sensitive content generation and delivery. This combination of shared, mutiple media visiting with context-sensitive content is unique as far as we know. Our future work involves elaborating and refining the interaction design, incorporating logging and path-based recommending, and expanding into the wider city.

ACKNOWLEDGMENTS

This project is funded by the UK Engineering and Physical Sciences Research Council, and supported by a donation from the Hewlett-Packard Art & Science programme. We are also grateful to The Lighthouse and to The House for an Art Lover (www.houseforanartlover.co.uk) for the opportunity to test our ideas and our systems.

REFERENCES

1. Chalmers, M. Paths and Contextually Specific Recommendations, in DELOS/NSF Workshop on Personalisation and Recommender Systems, 2001.
2. Harrison, S. and P. Dourish. Re–Place–ing Space: The Roles of Place and Space in Collaborative Systems, in Computer Supported Collaborative Work, 1996, ACM Press, 67-76.
3. Michaelides, D., et al. Auld Leaky: A Contextual Open Hypermedia Link Server, in Open Hypermedia Systems, 2001, Springer.
4. Randell, C. and H. Muller. Low Cost Indoor Positioning System, in Ubiquitous Computing, 2001, ACM Press, 42-48.
5. Woodruff, A. and B. Grinter. Sotto Voce: Exploring the Interplay of Conversation and Mobile Audio Spaces, in Human Factors in Computing Systems, 2002, ACM Press, to appear.